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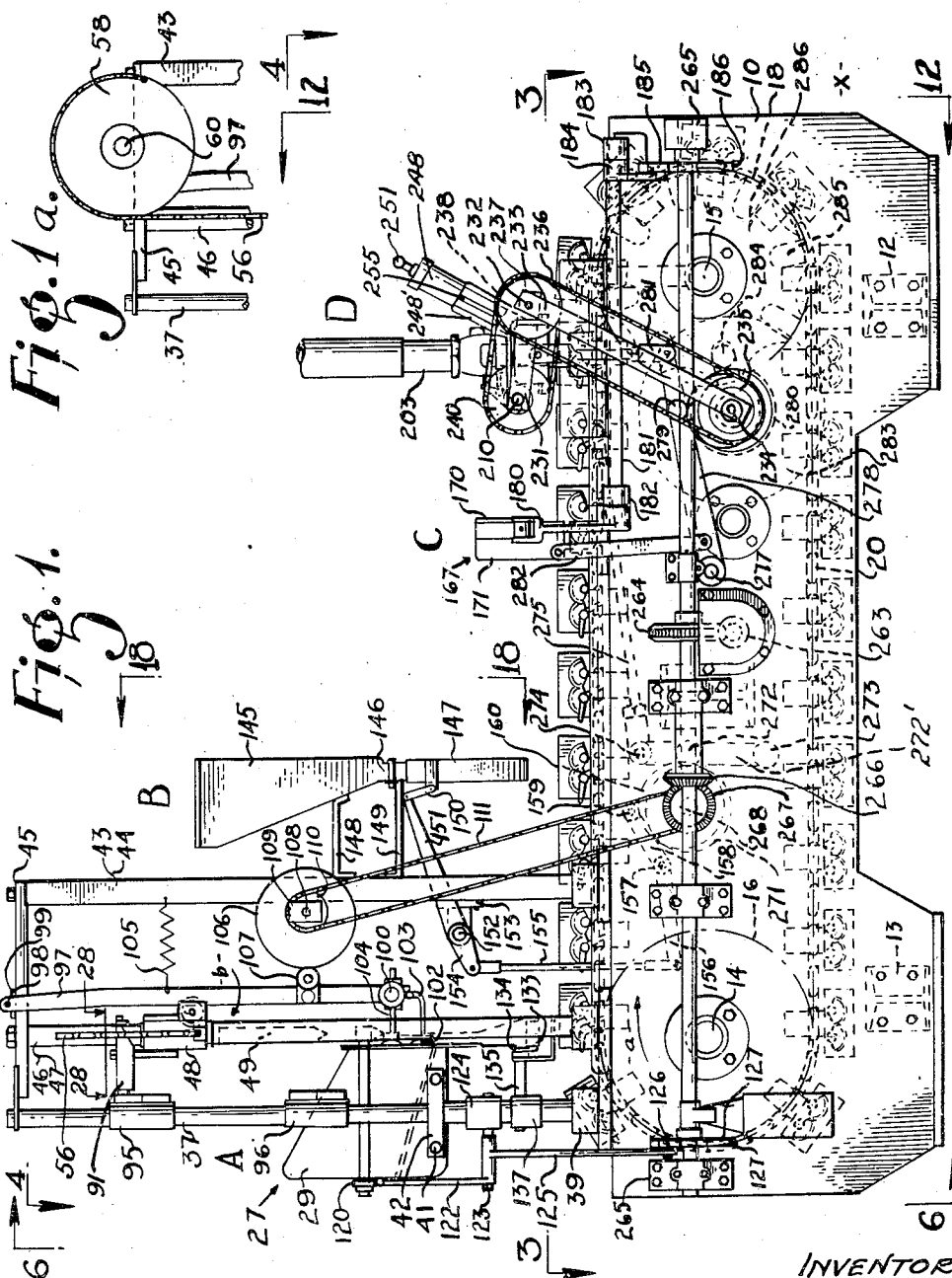
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2,482,609

VACUUM SEALING MACHINE

Original Filed June 9, 1942

12 Sheets-Sheet 1



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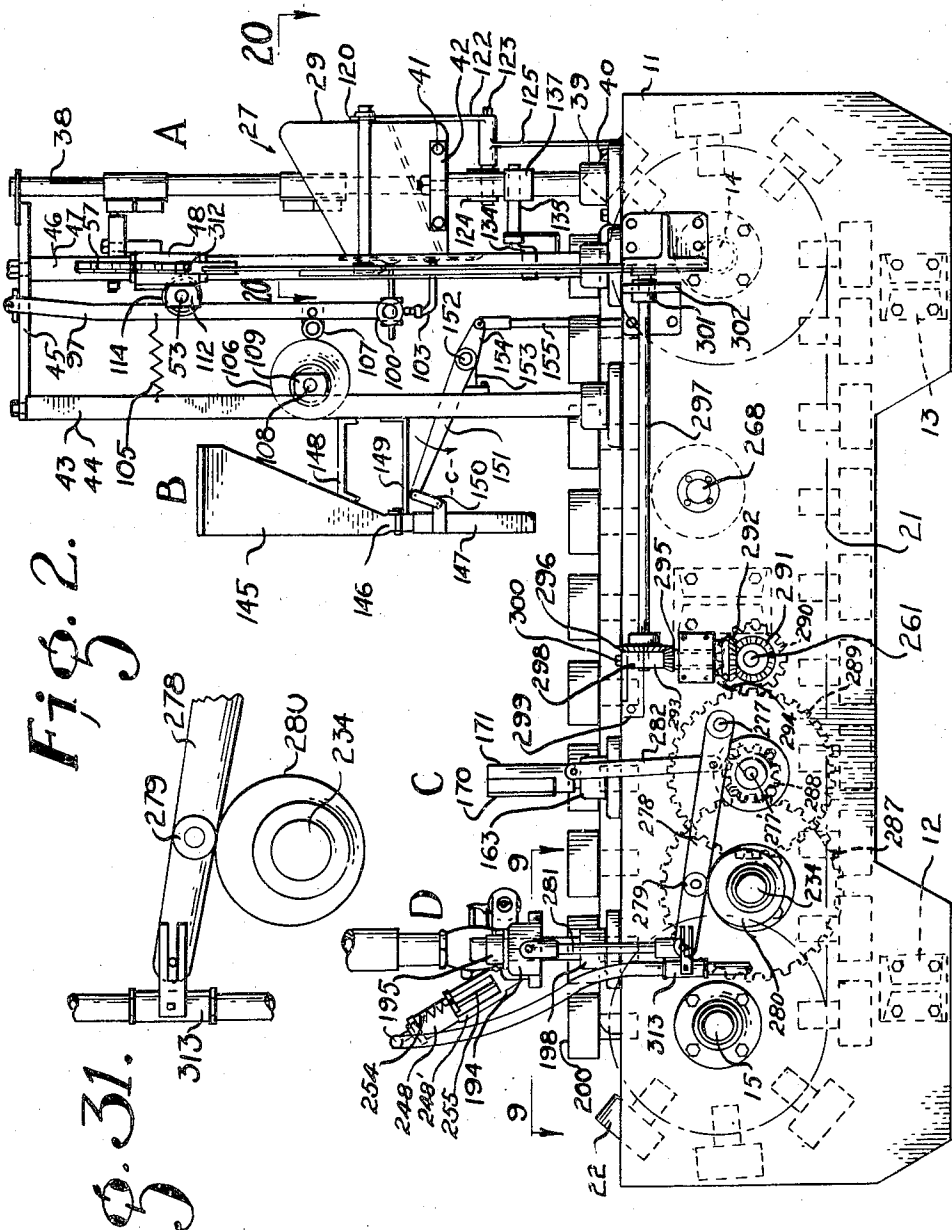
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2,482,609

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Original Filed June 9, 1942

12 Sheets-Sheet 2



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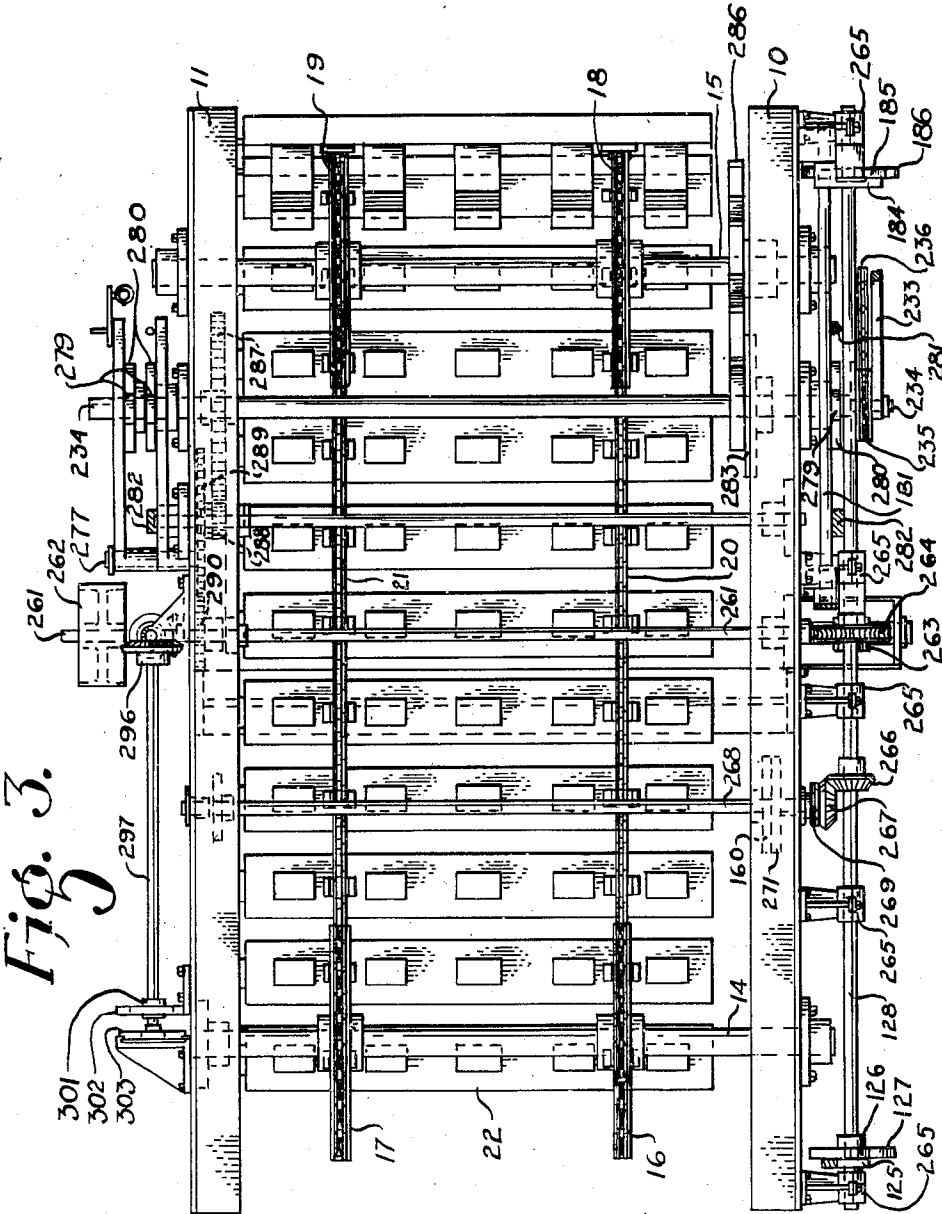
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VACUUM SEALING MACHINE

Original Filed June 9, 1942

12 Sheets-Sheet 3



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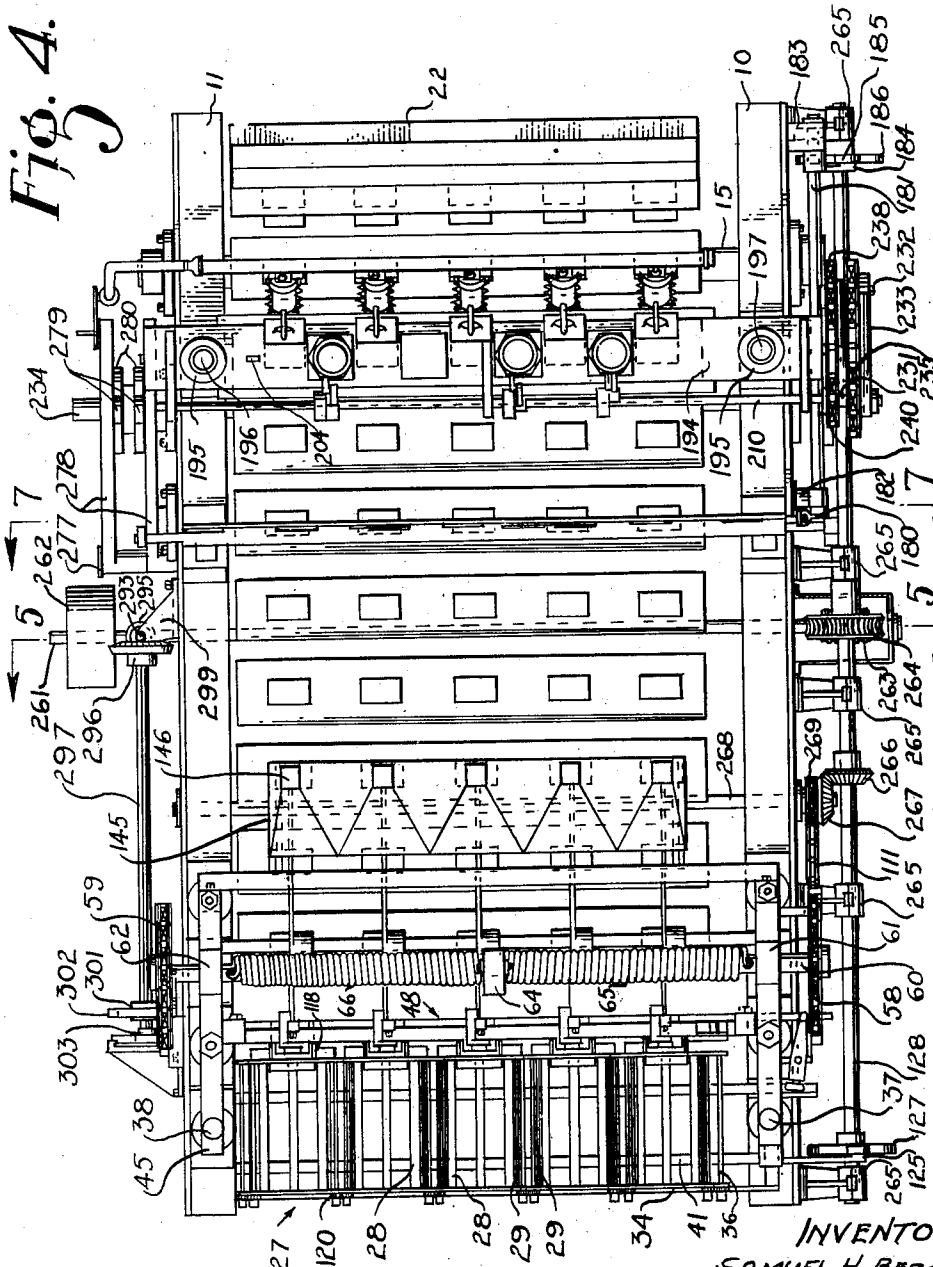
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2,482,609

VACUUM SEALING MACHINE

Original Filed June 9, 1942

12 Sheets-Sheet 4



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Original Filed June 9, 1942

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Fig. 5.

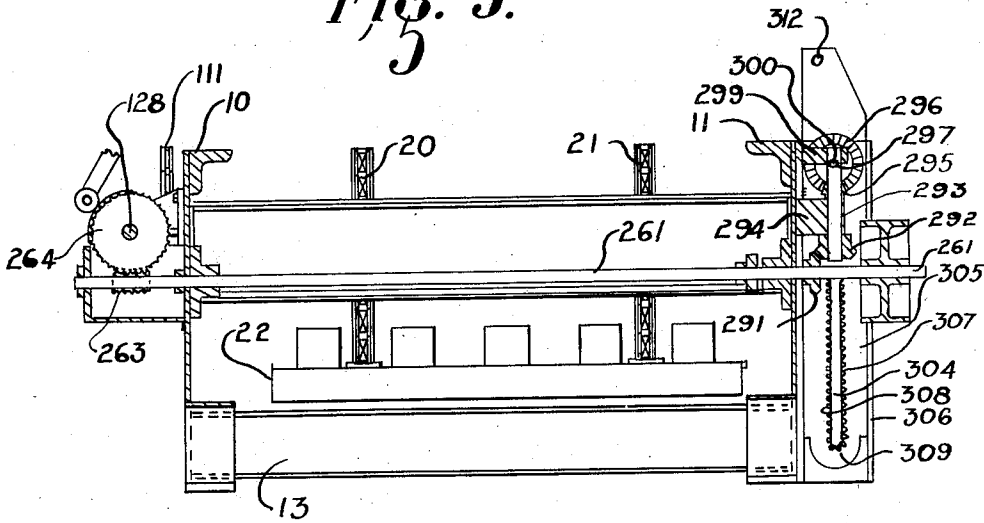


Fig. 13.

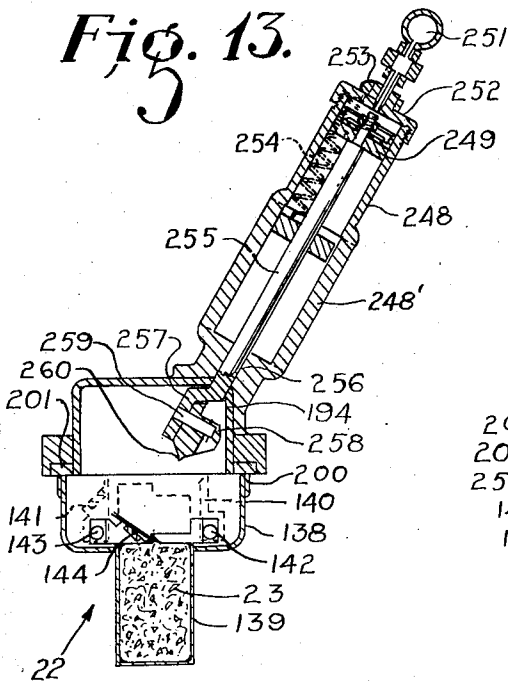
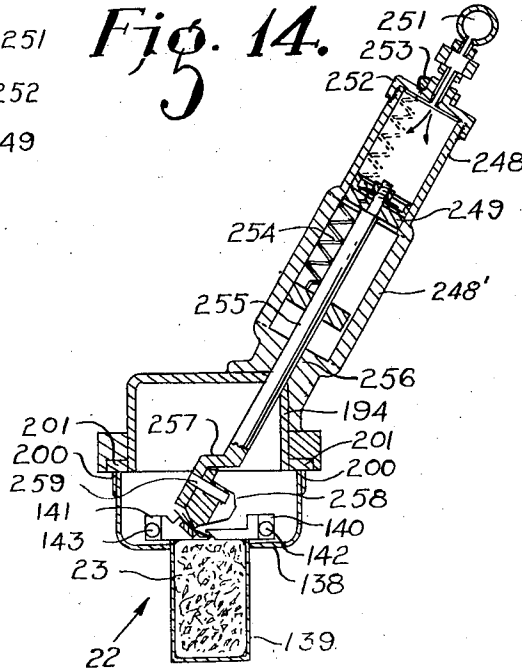


Fig. 14.



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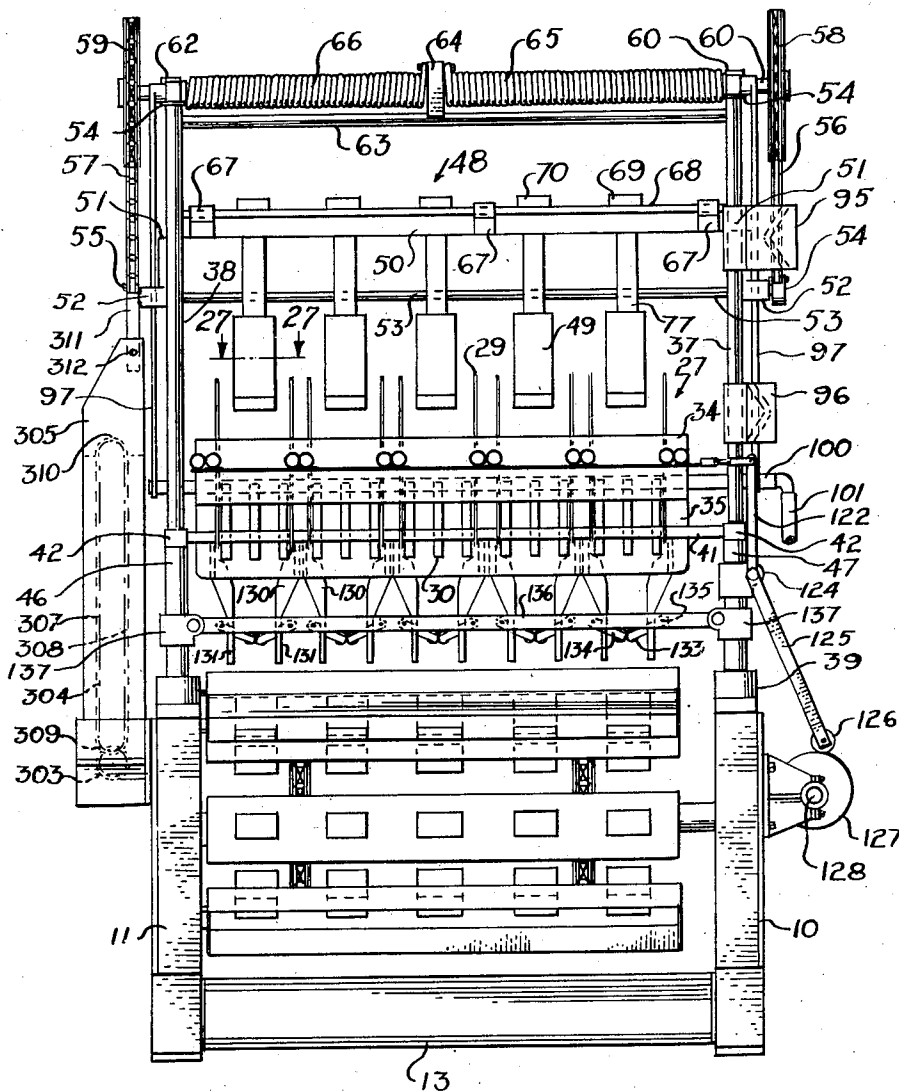
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Fig. 6.



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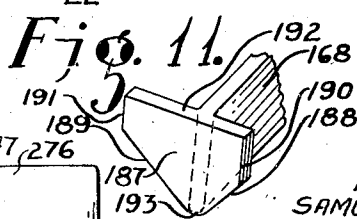
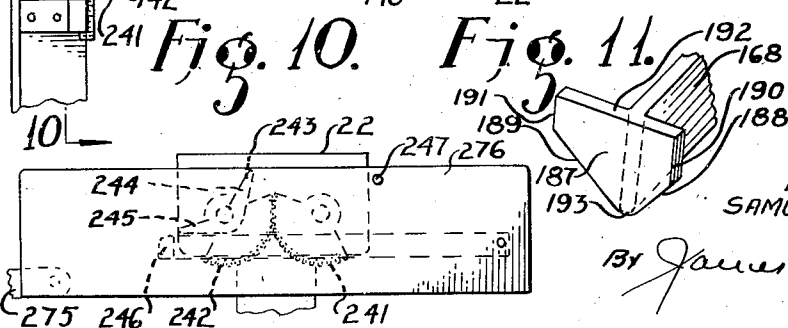
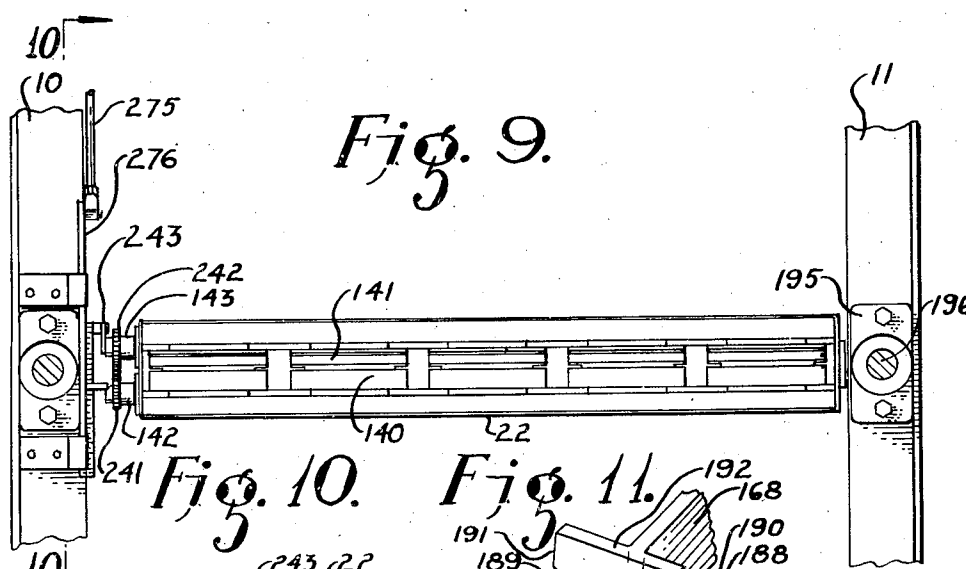
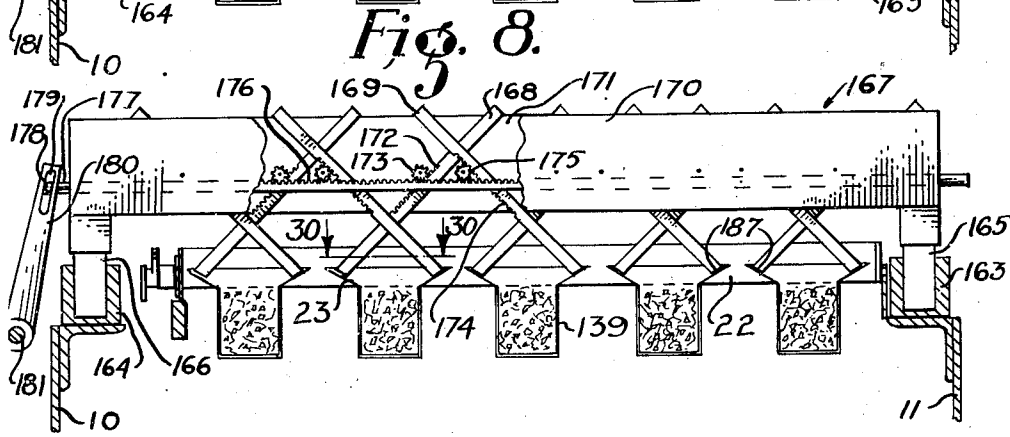
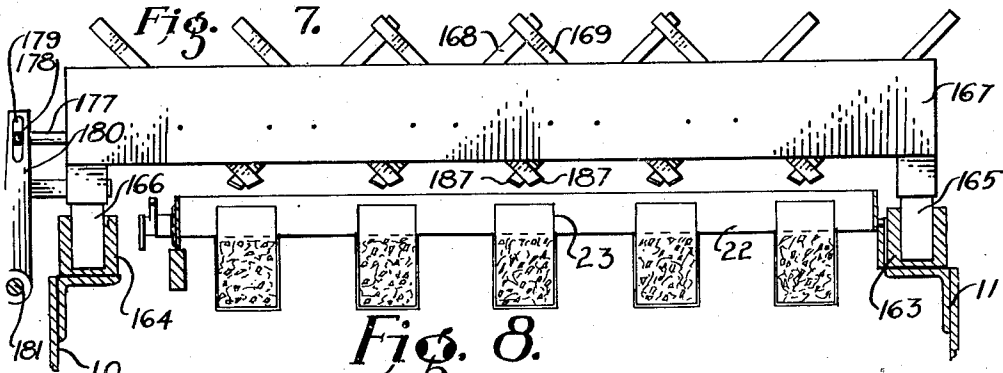
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VACUUM SEALING MACHINE

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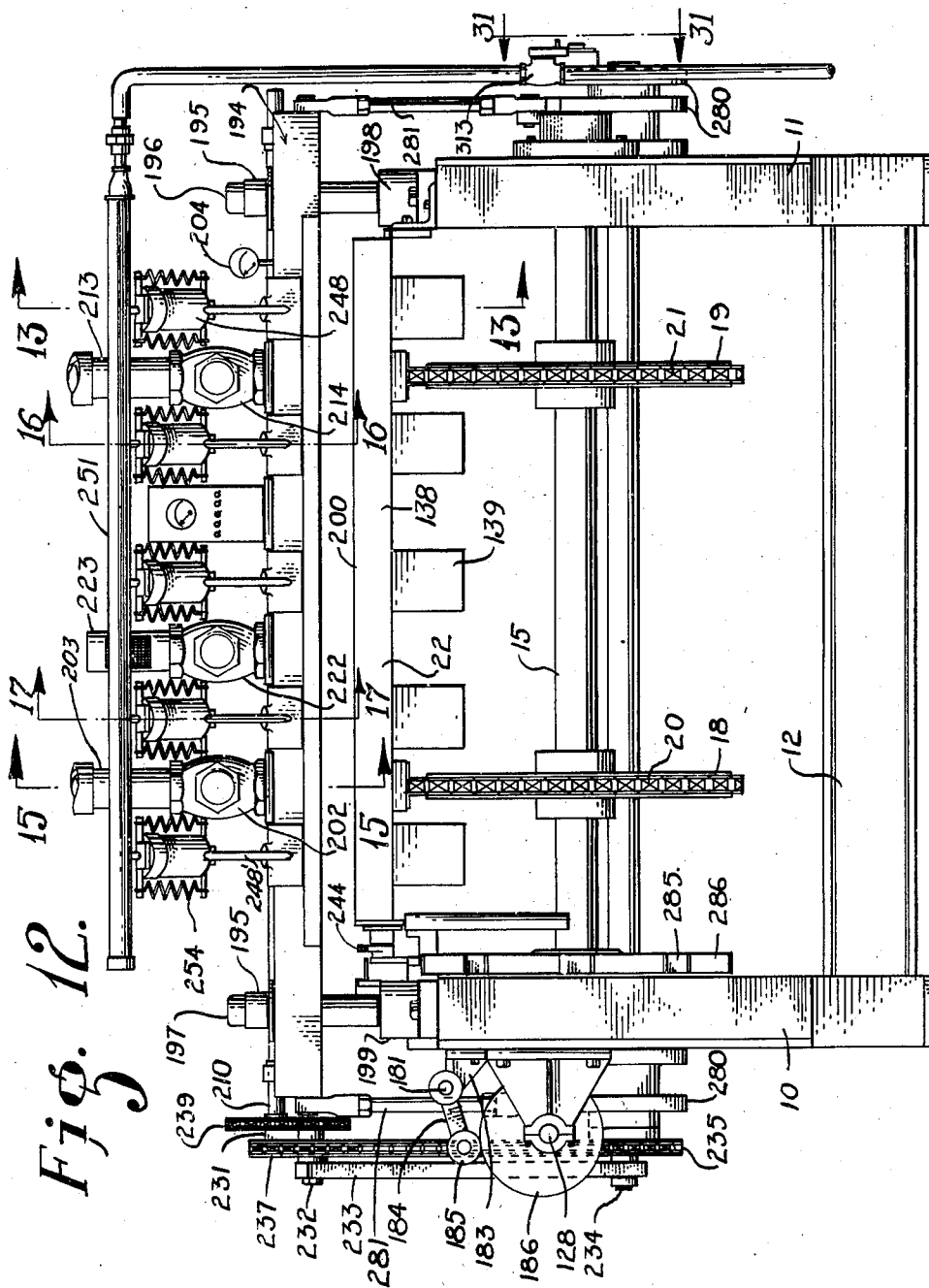


Fig. 12.

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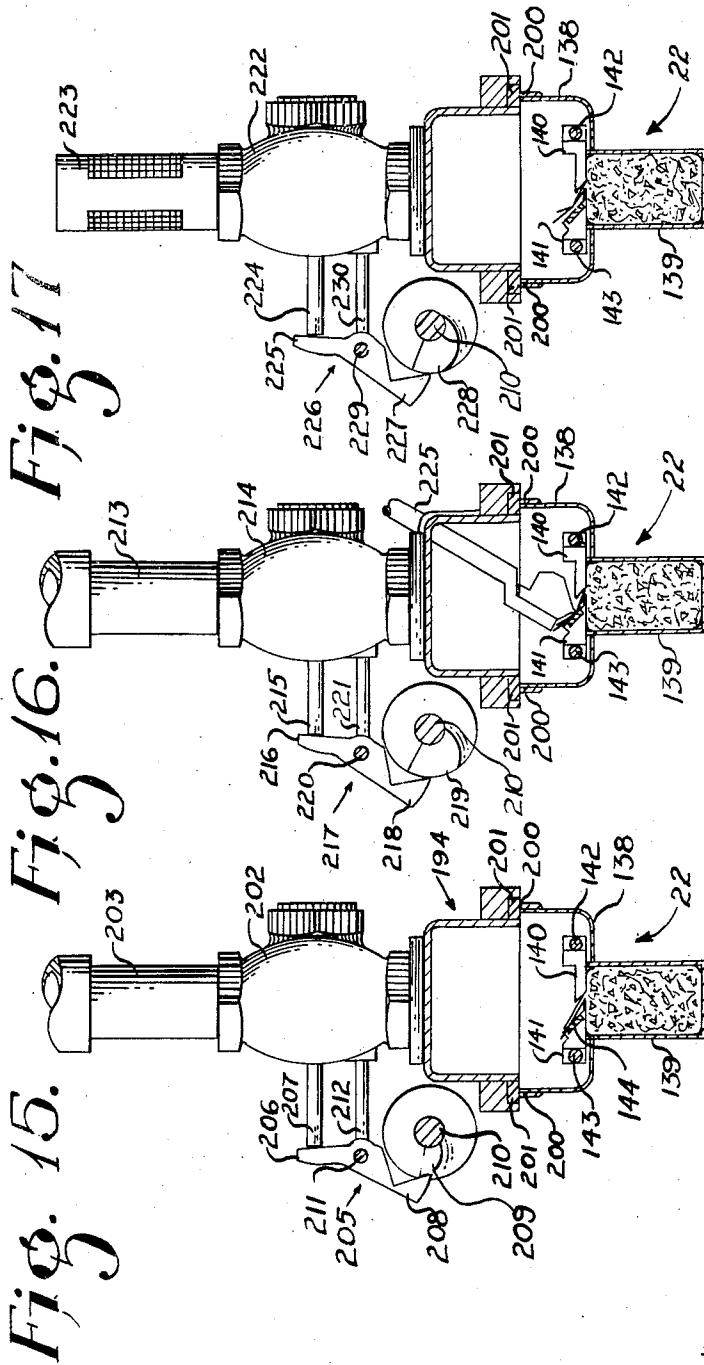
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2,482,609

VACUUM SEALING MACHINE

Original Filed June 9, 1942

12 Sheets-Sheet 9



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VACUUM SEALING MACHINE

Original Filed June 9, 1942

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Fig. 18.

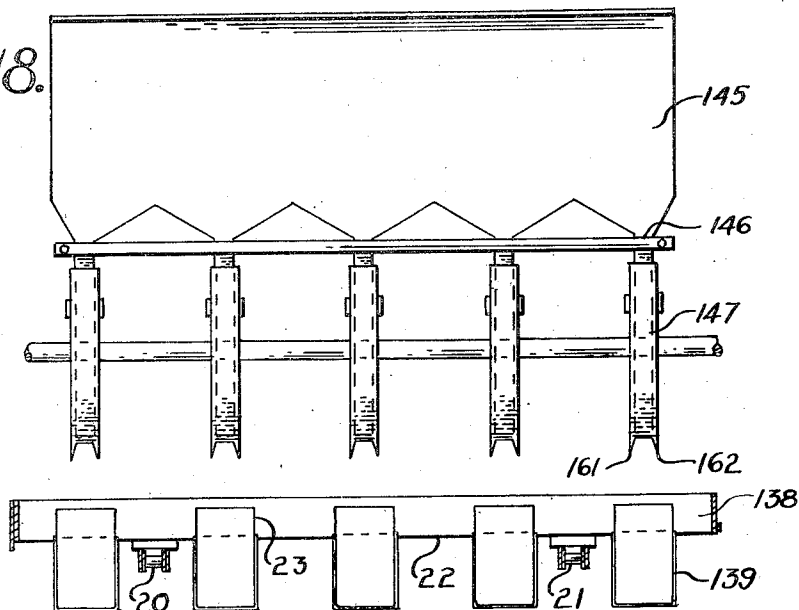
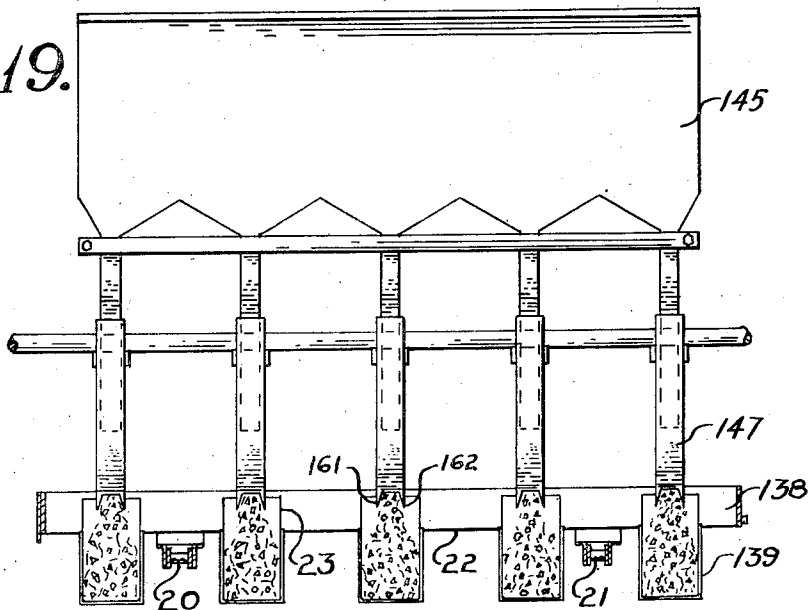


Fig. 19.



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Fig. 20

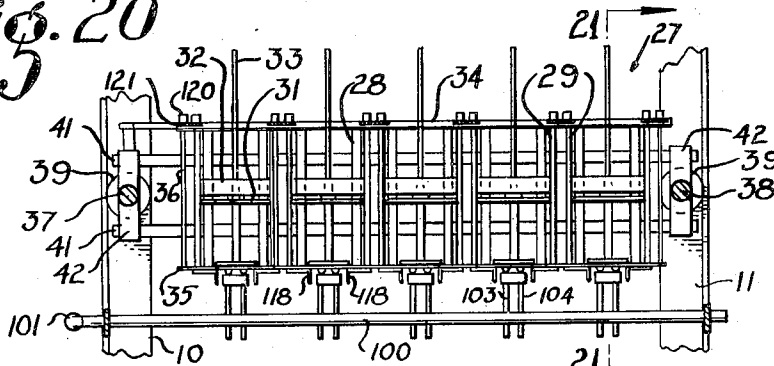


Fig. 21

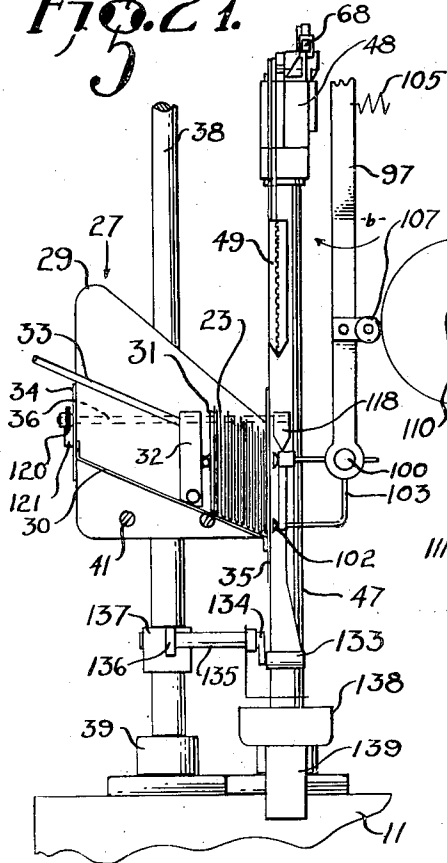
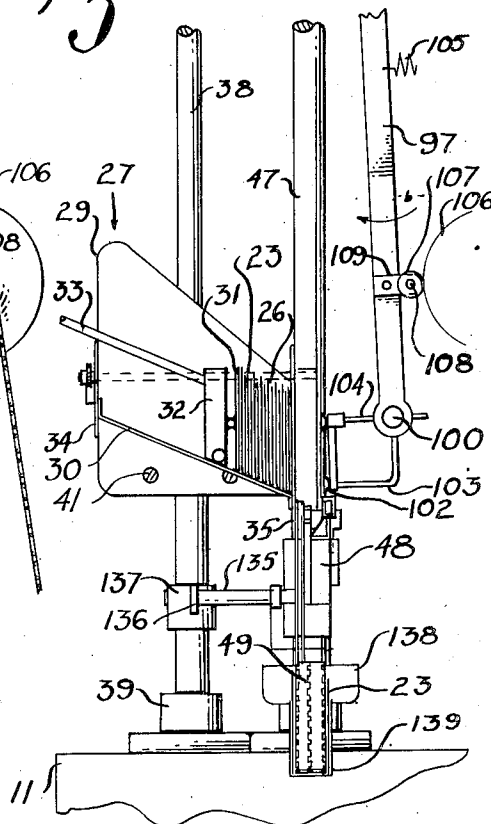


Fig. 22



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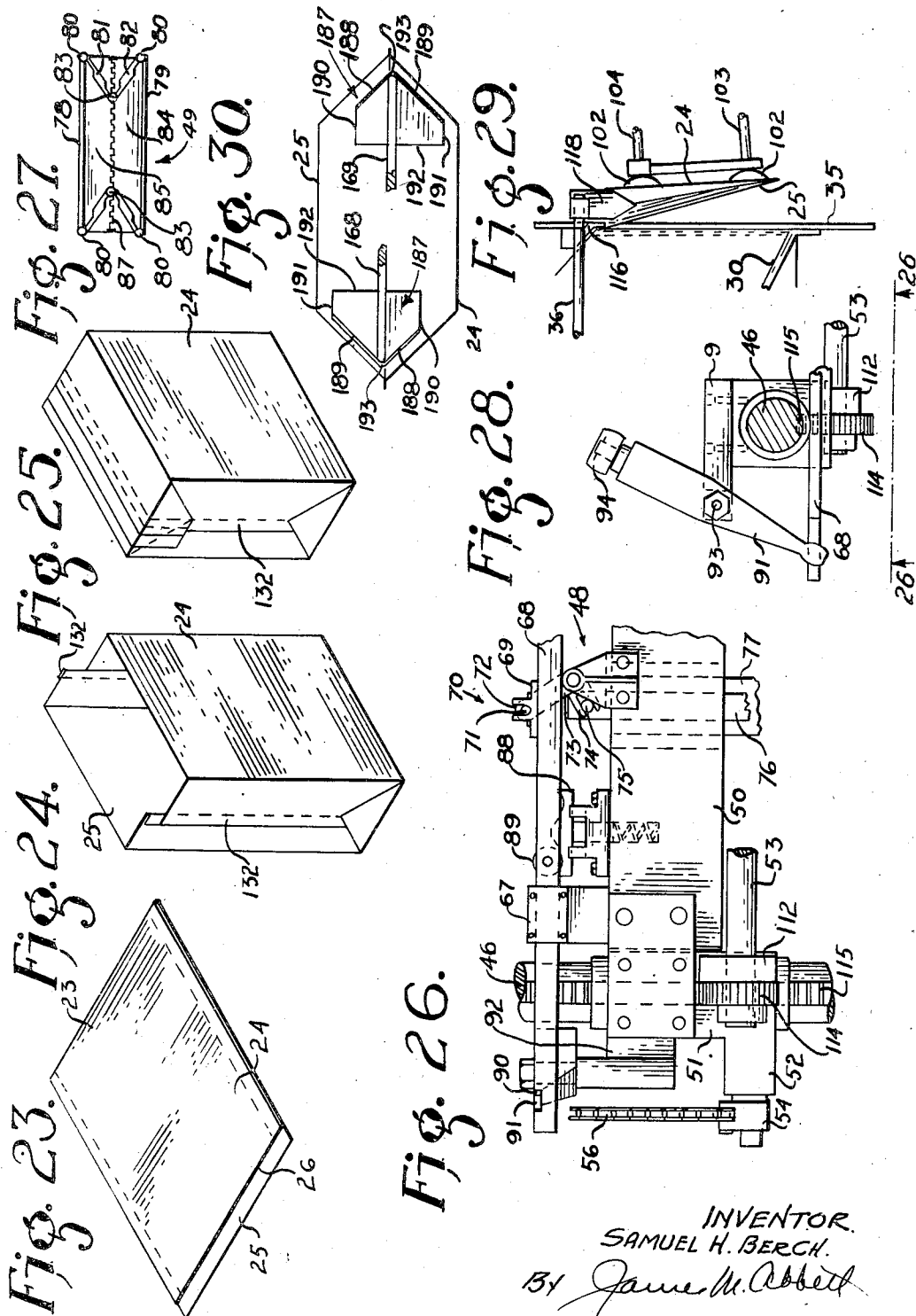
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VACUUM SEALING MACHINE

Original Filed June 9, 1942

12 Sheets-Sheet 12



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UNITED STATES PATENT OFFICE

2,482,609

VACUUM SEALING MACHINE

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Original application June 9, 1942, Serial No.
450,297. Divided and this application May 15,
1947, Serial No. 748,204

2 Claims. (Cl. 93-6)

1

This invention relates to mechanism for forming, filling and vacuum sealing packages, and particularly pertains to a vacuum sealing machine, this application being a division of my application entitled "Vacuum packaging machine," Serial No. 450,297, filed by me June 9, 1942, now Patent No. 2,428,192, issued September 30, 1947.

At the present time considerable development work is being done in connection with the formation of packages within which various products are vacuum sealed, such packages being of the general character as shown in my Patent No. 2,102,716 entitled "Method and means of packaging food products and the like" issued December 21, 1937. These packages are characterized as being formed from flexible sheet material into a flat folded bag-like package blank having heat sealed seams. These blanks are positioned within a magazine from which they are consecutively removed and fed to bag forming means, then filled and seamed under conditions of vacuum. The container performs many functions and provides benefits in the packaging of foods and the like which are not found or obtained when using tin or glass containers. It is desirable to provide a machine within which the container blanks may be placed, rapidly withdrawn and formed to receive a product, thereafter vacuum sealed within the container, and it is the principal object of the present invention to provide a vacuum packaging machine which is compact in construction and design, will occupy a relatively small amount of floor space, and will act in an automatic manner to form, fill and seal flexible containers within which a product is packaged and held under a condition of vacuum.

The present invention contemplates the provision of a machine having a unitary frame structure carrying synchronous driving means, whereby an endless conveyor may travel from a magazine station to a filling station, and then through a vacuum sealing station, during which time a container is removed from the magazine, folded to give it its definite form, and thereafter filled and sealed, all of said operation taking place automatically and rapidly so that the packaging of food may be carried out economically and with a minimum amount of labor.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a view in side elevation showing the completely assembled machine with the upper portion of the bag forming machine broken away.

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Fig. 1* is a fragmentary view in side elevation showing the upper portion of the bag forming unit which was broken away in Fig. 1.

Fig. 2 is a view in side elevation showing the opposite side of the entire machine from that disclosed in Fig. 1.

Fig. 3 is a view in horizontal section through the assembled machine as seen on the line 3-3 of Fig. 1 and discloses the conveyor mechanism and the drive for the various units of the machine.

Fig. 4 is a view in plan showing the completely assembled machine.

Fig. 5 is a view in vertical section through the machine as seen on the line 5-5 of Fig. 4.

Fig. 6 is a view in end elevation showing the discharge end of the machine.

Fig. 7 is a view in transverse section showing the bag spreading mechanism as seen on the line 7-7 of Fig. 4 and with the spreaders retracted.

Fig. 8 is a view similar to Fig. 7 showing the spreading fingers in a spreading position within the mouth of the bag.

Fig. 9 is a view in plan showing the folding mechanism for the mouth of the bag.

Fig. 10 is a view in transverse section on the line 10-10 of Fig. 9 showing the trip mechanism for the mouth of the bag.

Fig. 11 is a fragmentary view in perspective showing the special formation of the ends of the spreading fingers which fit into the mouth of the bag.

Fig. 12 is an enlarged view in end elevation showing the vacuumizing and heat sealing mechanism.

Fig. 13 is a view in vertical section through the vacuumizing and heat sealing mechanism as seen on the line 13-13 of Fig. 12 and shows the heat sealing element as being in its retracted position.

Fig. 14 is a view similar to that shown in Fig. 13 with the heat sealing element in its contacting position.

Fig. 15 is a view in vertical section as seen on the line 15-15 of Fig. 12 and discloses a suction control valve in its low suction position.

Fig. 16 is a view in vertical section and elevation as seen on the line 16-16 of Fig. 12 and showing the high suction valve in its open position.

Fig. 17 is a view in vertical section and elevation as seen on the line 17-17 of Fig. 12 and shows the release valve in its open position.

Fig. 18 is a fragmentary view in elevation as seen on the line 18-18 of Fig. 1 and discloses the filling hoppers in their retracted positions.

Fig. 19 is a view similar to Fig. 18 showing the filling hoppers with their spouts lowered to enter the mouth of the container for filling the same.

Fig. 20 is a fragmentary view in plan showing the arrangement of the bag openers and the magazines.

Fig. 21 is an enlarged fragmentary view in side elevation showing the bag opening mechanism in its retracted position.

Fig. 22 is a view similar to Fig. 21 showing the bag opening mechanism in its projected position.

Fig. 23 is a view in perspective showing the folded container blank.

Fig. 24 is a view in perspective showing the formed bag prior to filling.

Fig. 25 is a view in perspective showing the final filled and sealed package.

Fig. 26 is a fragmentary view as seen on the line 26—26 of Fig. 28 and shows a portion of the operating mechanism of the bag expanding elements.

Fig. 27 is a view in horizontal section on the line 27—27 of Fig. 6 and shows the parts of a bag expanding element.

Fig. 28 is a view in horizontal section on the line 28—28 of Fig. 1 and shows part of the operating mechanism for the bag expanding units.

Fig. 29 is a fragmentary view in side elevation showing the elements for withdrawing a bag from the bag magazine as indicated in Figs. 21 and 22 and which in this figure show the bag in a partially withdrawn position.

Fig. 30 is an enlarged view in horizontal section showing the bag spreading device as seen on the line 30—30 of Fig. 8.

Fig. 31 is an enlarged fragmentary view showing a portion of the lifting device for the seaming head.

Referring more particularly to the drawings, 10 and 11 indicate base plates. These plates are spaced vertically and are disposed parallel to each other. They are secured together by cross beams 12 and 13. Rotatably supported by the base plates are horizontal conveyor shafts 14 and 15. These shafts are disposed in spaced parallel relation to each other and lie in the same horizontal plane. Mounted upon the shaft 14 is a pair of conveyor sprockets 16 and 17. Mounted upon the shaft 15 is a pair of conveyor sprockets 18 and 19. A conveyor chain 20 is led around sprockets 16 and 18, and a conveyor chain 21 is led around sprockets 17 and 19. These chains carry mold units 22. The mold units are shown in detail in Figs. 13 and 14 of the drawings and will be described more specifically hereinafter. It should be pointed out, however, that each mold unit is provided with pockets to receive a plurality of flexible bag-like containers which are to be filled and sealed in the machine with which this invention is concerned. The sprocket chains 20 and 21 are driven simultaneously and intermittently and successively move beneath a bag magazine station A, a filling station B, a spreading station C, and a vacuum sealing station D.

Bag magazine and forming mechanism

The container with which the present invention is concerned is a flexible bag-like container made by folding a sheet of laminated material upon itself, and then sealing the meeting faces of the folded leaves along their opposite marginal edges. Such a container is shown in Fig. 23 of the drawings. Here it will be seen that the folded leaves are of slightly different length, the bag being generally indicated at 23, so that the upper

leaf 24 will be shorter than the lower leaf 25, thus providing an extension of the leaf 25 beyond the end of the leaf 24 to facilitate in handling the bag and opening the mouth 26 during the forming operation. The bag when formed at the station A will appear as generally shown in Fig. 24 of the drawing, and when in its final filled and sealed condition will appear as indicated in Fig. 25 of the drawing. The details of these structures will be hereinafter explained.

The flat folded bag blanks 23 are positioned within a magazine structure, generally indicated at 27 and as being a part of the magazine and forming station A. It is to be understood that the present machine has been designed to act simultaneously upon five blanks or packages as the operation of the machine progresses. In certain instances it may be found desirable to prolong a vacuumizing operation to slowly draw the air from a group of packages, in which instance alternate groups of packages may be vacuum treated while other groups are being formed and filled.

The bag magazine and forming structures are shown particularly in Figs. 1, 2, 20, 21 and 22 of the drawings. Here it will be seen that the magazine 27 provides a plurality of hoppers 28 which are separated from each other by vertical plates 29. Disposed between the vertical plates and inclined downwardly and toward the discharge end of the machine are floor sections 30. Upon these floor sections a plurality of the flat folded bag blanks 23 are stacked in parallel vertical alignment and with their mouths 26 presented upwardly. Mounted in each of the hoppers 28 is a follower plate 31 which moves against the back face of the group of bag blanks and forces them downwardly and forwardly toward the discharge ends of the hoppers. Disposed in the rear of each follower plate is a weight 32 having a handle 33, the weight adding pressure to the follower plate to successively move the outermost blank to the discharge opening as a preceding blank is withdrawn from the magazine.

The complete magazine structure is held together by a back plate 34 and a front plate 35. These receive shafts 36. The magazine is supported by standards 37 and 38 disposed at the opposite ends of the magazine and mounted in seats 39 secured to the base plates 10 and 11 by bolts 40. Extending through the plates 29 and beneath the floor 30 of the hoppers are rods 41 which are fastened to cross arms 42 carried by the standards 37 and 38. These standards extend a considerable distance above the magazine 27 and carry a superstructure from which the bag forming mechanism is suspended. Cooperating with the standards 37 and 38 are cross frame members 45. Guide standards 46 and 47 are provided intermediate the two sets of supporting standards and carry a cross-head 48 which slides vertically on the standards 46 and 47. This cross-head provides a support for a series of bag forming elements 49, one of which is complementary to a bag hopper 28. The cross-head 48, as shown in Fig. 6 of the drawings, comprises a cross-bar 50 on which the bag spreading elements 49 are disposed in spaced relation to each other. The member 50 is fitted with bearing blocks 51 at its opposite ends which blocks are formed with an outwardly projecting boss 52 and attaching members 54 and 55. Mounted on the bearing blocks 51 is a shaft 53. Sprocket chains 56 and 57 are secured to the attaching members 54 and 55, respectively, and are led around sprocket wheels

58 and 59. The sprocket wheels 58 and 59 are mounted upon a shaft 60 which extends through bearings 61 and 62 carried on the cross frame members 45. A tie rod 63 extends from one cross frame member 45 to the other. This carries a central standard 64 through which the shaft 60 also extends. Coiled around the shaft 60 at opposite sides of the standard 64 are coil springs 65 and 66. These springs are secured to the standard by one of their ends and are secured to the shaft adjacent to their opposite ends. Thus, the weight of the cross-bar 50 and the spreading units 49 is counterbalanced by these springs, which will coil and recoil as the cross-head reciprocates vertically.

The cross-head is provided with bearings 67 through which a shaft 68 extends and is mounted for horizontal reciprocation. This shaft carries a plurality of blocks 69 which are each formed with an upwardly opening slot 70. These slots receive pins 71, each of which is mounted on the free end of a lever arm 72, which forms part of bell cranks 73. The other arm 74 of each of the bell cranks is fitted with a slotted end to receive a pin 75. The pins 75, engaging each of the bell cranks, are mounted on spreading bars 76. These spreading members extend downwardly into the bag forming units through guides 77 which are carried by the cross-head 48 and will act to shift the members 76 in expanding and contracting the bag forming elements 49. These elements are shown in Fig. 27 as having opposite side walls 78 and 79 with hinges 80 along their vertical edges. These hinges connect with wall sections 81 and 82 which are secured together by an intermediate hinge 83. The width of the walls 78 and 79 represent the width of a package to be formed. The combined width of plates 81 and 82 represents the thickness of the package to be formed. Carried at the lower end of the plates 78 and 79 are end walls 84 and 85 which are hinged to the side walls 78 and 79 by hinges 86 and are hinged together by an intermediate hinge 87. The bars 76 bring the end walls 84 and 85 into horizontal alignment and thus spread the form to a shape which defines the inner contour of the bag, as shown in Fig. 24 of the drawings. This operation is produced when the shaft 68 is shifted longitudinally through the bearings 67. A lock cam 88 is carried on the shaft and is engaged by a lock roller 89 which is yieldably held on the cam and will temporarily hold the rod 68 in either of its extreme positions.

The end of the shaft 68 is formed with a groove 90 within which a shifting lever 91 is mounted. This lever mechanism is shown in Fig. 28 of the drawings, where it will be seen that it is carried on an arm 92 of the cross-head structure 48 and is mounted on a pivot pin 93. The opposite free end of the lever carries a roller 94 which engages an upper cam block 95 mounted upon the standard 37 and disposed near the upper end of the vertical movement of the cross-head 48. In the lowermost position of the cross-head the roller of lever 91 engages a cam block 96 carried on the standard 37 which acts upon the lever to shift the rod 68.

Pivotally mounted upon the cross frame structure 45 is a vacuum cup arm 97 which is carried upon a pivot pin 98 within a bearing 99. The arm extends downwardly and is fitted at its lower end with an air manifold 100 connected with a suction pipe 101. The manifold carries a plurality of vacuum cups 102 which communicate with the manifold through tubes 103 and 104. These vacuum cups are arranged in pairs in ver-

tical alignment and engage the front face of the outermost container blank 23 in the hoppers of the magazine 27. The arm 97 is fitted with a spring 105 which tends to draw the free end of the arm away from the magazine 27. An eccentric cam 106 is provided to bear against a roller 107 on the arm 97 and to force it inwardly. The eccentric cam 106 is mounted on a shaft 108 carried in bearings 109. The bearings 109 are mounted on the uprights 43 and 44. A sprocket 110 is carried upon the shaft and is driven by a sprocket chain 111 through means to be hereinafter described.

Mounted upon the cross-head structure 48 and in bearings 112 is cross-shaft 53. This shaft is fitted at its opposite ends with gears 114 which mesh with a gear rack 115 cut in the face of the two uprights 46 and 47. This causes the cross-head with the forming units carried thereby to move vertically while maintained in exact horizontal alignment. When the forming units 49 do move vertically they pass downwardly and across the open end of the hoppers of the magazine 27 and strip the outermost bag from the stack of bags within the magazine. The upper edge of the magazine is formed with a lip 116. Due to the fact that the bag blank has a side 25 which is longer than the side 24, there will be a tendency for the suction cups to pull the side 24 outwardly while the upper edge of the side 25 is temporarily held by the lip 116. In order to hold the mouth of the bag open when this operation takes place spreading fingers 118 are provided to swing into the open mouth of the bag and temporarily hold it open so that when the forming unit 49 is lowered it will easily enter the mouth of the bag. These spreading fingers are mounted upon operating shafts 36 which are rotatably supported upon the magazine structure and are fitted at their opposite ends with a gear 120. The gear 120 is in mesh with a cross-rack 121, the end of which is secured to a lever 122. This lever is mounted upon a pivot shaft 123 supported by fittings 124 upon the uprights 37 and 45. The lever 122 is formed integral with a lever 125 which extends downwardly and carries a cam roller 126 at its free end. This roller bears against the circumference of a disc cam 127. The disc 127 is mounted upon a horizontally extending cam shaft 128, which will be described in detail hereinafter.

Disposed upon the front plate 35 of the magazine is a series of pairs of forming plates 130. These plates flare downwardly and inwardly and have lower parallel portions 131 between which the package is formed, and its vertical edge seams 132 are folded over as shown in Fig. 24 of the drawings. Cooperating with the plates 130 are sets of rollers 133 carried upon swinging arms 134, and which arms yieldably bear against the seam portions 132. The opposite ends of the arms are mounted upon pivot pins 135 carried upon a cross-bar 136. This bar is mounted at its opposite ends upon sleeves 137 carried upon the uprights 46 and 47.

Conveyor system

As has been previously described, this machine is provided with a conveyor system which includes sprockets 16 and 17 at the entry end of the machine, and sprockets 18 and 19 at the opposite end of the machine. These sprockets carry sprocket chains 20 and 21 upon which are mounted mold carrying units 22 including trough-like members 138 which are arranged

parallel to each other and stand transversely of the path of travel of the chains, so that they will pass beneath the mechanism at the various operating stations of the machine. Each of the trough members 138 is provided with a plurality of molds 139. These molds have upper open ends lying substantially flush with the bottom of the trough carrying it and extends downwardly to form a compartment having the configuration of the package to be formed in the machine. The position of the molds along the trough causes these molds to register with the series of spreading units 49 which have been previously described, and which units carry the formed empty containers 23 downwardly into the molds so that they can be filled.

The troughs are provided with a pair of folding fingers 140 and 141. These fingers are mounted upon pivot pins 142 and 143, respectively, and may swing vertically to positions across the mouth of the molds to hold the mouth of the bag in a folded position preparatory to heat sealing, as will be hereinafter described. The fingers 140 are provided with a pressure plate 144 upon which the seam portion of the mouth of the bag rests during the heat sealing operation. Normally, the fingers 140 and 141 are swung upwardly in parallel vertical positions, as shown in Fig. 13 of the drawings. When in this position the opened end of the container 23, such as shown in Fig. 24 of the drawings, and the container will thus be ready for filling when it registers with the filling station, indicated in Fig. 1 at B.

Filling Mechanism

Referring particularly to Figs. 18 and 19, it will be seen that a storage bin 145 is provided having a plurality of outlets 146. These outlets extend vertically from the bottom of the bin and have slidably mounted upon them tubular spouts 147. The storage bin 145 is mounted on the uprights 43 and 44 by brackets 148 and 149. The spouts 147 are supported by links 150 carried at the free ends of lever arms 151. These lever arms are mounted on pivot pins 152 carried by brackets 153. A lever arm 154 is integral with the lever arm 151 and is fastened to an operating rod 155. The operating rod 155 extends downwardly and is pivotally connected to a lever 156 carried upon a pivot pin 157 on the bed plate structure of the machine. A lever 158 is formed integral with the lever 156 and carries a roller 159 which bears against a cam 160. Through this mechanism the tubular spouts 147 are vertically reciprocated. As shown in Figs. 18 and 19 of the drawings, the spouts are rectangular in cross-section and have their front and back walls cut away to form two downwardly extending fingers 161 and 162. These fingers tend to direct the material from the bin into the formed bags 23 which are supported within the molds 139 carried by the travelling conveyor chains 20 and 21.

Bag spreading means

It has been explained in my Patent No. 2,277,288 issued March 24, 1942, that after a bag 23 has been filled it is desirable to stretch the mouth of the bag by pressure at opposite sides of the mouth to draw the marginal edges of the bag together to form a longitudinal slot, and to give a preliminary shape to the mouth of the bag prior to folding and heat sealing. A structure for performing this particular function is shown at station C in Fig. 1, and the details of this structure

are shown more particularly in Figs. 7, 8 and 11 of the drawings. Here it will be seen that the opposite bed plates 10 and 11 carry sockets 163 and 164 which receive standards 165 and 166. These standards are secured to a cross frame structure 167. Mounted on the cross frame structure 167 are sets of spreading bars 168 and 169. These are held to slide between pairs of plates 170 and 171, and are disposed at right angles to each other. The bars cross each other, so that they may move from a retracted position, as shown in Fig. 7, to an extended and expanded position, as shown in Fig. 8. The bar 168 is formed with a gear rack 172 in mesh with a pinion 173. The bar 169 is formed with a gear rack 174 in mesh with a pinion 175. The pinions are carried between the plates 170 and 171 of the supporting member 167. Each of these pinions is also in mesh with a gear rack 176 formed upon a rack bar 177. The rack bar 177 is slidable transversely of the machine and is fitted with a pin 178 extending into a slotted opening 179 of a lever 180. The lever 180 is secured at the end of a shaft 181 mounted in a frame bearing 182, as shown in Fig. 1. The shaft also extends into a bearing 183 and carries a cam arm 184 upon which a cam roller 185 is mounted, as shown in Fig. 12. The roller 185 engages the periphery of a cam disc 186 which is carried upon the shaft 128. The ends of the spreading bars 168 and 169 are of special configuration, as shown in perspective in Fig. 11 of the drawings. Here it will be seen that transversely extending spreading elements 187 are formed at the ends of the spreading bars 168 and 169. These spreading elements 187 have a square back face 192 at right angles to the sides of the bag. Outer faces 188 and 189 are formed on each of the elements 187 to contact the mouth of the bag. These faces are at right angles to each other, although the length of the face 189 is materially greater than the length of the face 188. Edge faces 190 and 191 are formed between the angular faces 188 and 189, respectively, and the back face 192. The edge face 190 is of greater length than the edge face 191. It will be evident that when the edge faces 190 and 191 contact the opposite sides 24 and 25 of the bag the point 193, representing the apex between the faces 188 and 189, will be off-center relative to the bag and will cause the end points to apply pressure at a point on one side of the longitudinal seam 132 of the bag blank. This prevents undue strain on the heat sealed seam 132, which would tend to weaken the bag and would be applied if the point 193 registered directly with the seam.

Vacuum sealing mechanism

After a group of molds 139 have been acted upon by the spreading bars and fingers at the bag spreading station the bag 23 is sealed. This takes place at the vacuum sealing station, indicated at D in Fig. 1.

The vacuum sealing mechanism comprises a head 194 which is an inverted trough-like member extending transversely of the frame. At opposite ends of the trough-like member are bearing blocks 195 formed with openings through which standards 196 and 197 extend. The standards are mounted in vertical positions in fastening blocks 198 and 199, respectively, secured to the bed plates 10 and 11. Thus, by this mechanism the head 194 may be moved bodily in a vertical direction, and when moved downwardly will register with a sealing lip 200 formed along the margin of the trough-like portion 138 carrying molds

139. The marginal edges of the head 194 are provided with sealing gaskets 201, which form a vacuum-tight seal with the member 138. Mounted above and in communication with the head 194 is a low vacuum control valve 202, which is connected with suction pipe 203. The pipe 203 connects with a manifold leading to a suction pump not shown in the drawings, and which pump exerts a suction to create a suitable partial vacuum condition within the structure. The amount of vacuum is indicated by a gauge 204 carried by the head 194. It is intended that suction action shall be progressively applied, and for that reason the pipe 203 is connected with the valve 202 whereby suction will be applied initially at a relatively low negative pressure. The valve 202 controls this structure and is operated by a lever 205 which has an arm 206 engaging a valve plunger 207 and an arm 208 which engages the surface of a cam 209. The cam is mounted upon a cam shaft 210. The lever 205 is mounted upon a pivot pin 211 carried by an arm 212. A suction pipe 213 is provided with a high vacuum valve 214, as shown in Fig. 16. This valve has a plunger 215 engaged by an arm 216 of a lever 217. The opposite arm 218 of the lever 217 engages a cam 219 carried on the cam shaft 210. The lever 217 is mounted upon a pivot pin 220 carried by a supporting arm 221. By the mechanism described a low vacuum action is first created when valve 202 is opened and a high vacuum action is subsequently created when valve 213 is opened. This prevents the contents of the package from being drawn upwardly into the seam of the package as would occur under initial violent suction action, and would result in the formation of a seam which might not be vacuum-tight.

At the conclusion of the suction operation it is intended that the confined space within the mold 29 shall be opened to atmosphere, and therefore a valve 222 (Fig. 17) is provided having an air-pipe 223 connected to it. The valve 222 has a plunger 224 engaged by an arm 225 of a lever 226. Arm 227 of the lever 226 engages a cam 228 carried upon the cam shaft 210. This lever is mounted upon a pivot pin 229 carried by a supporting bracket 230.

A frame element 231, as shown in Fig. 1, is mounted at the end of the vacuum head 194 and pivots around the cam shaft 210 so that the vacuum head may have vertical movement without disturbing the relationship of the driving parts. The opposite end of the frame element 231 is pivoted upon a shaft 232 to a frame element 233 which extends downwardly and is pivoted on a transverse drive shaft 234. A sprocket 235 is mounted upon the drive shaft and carries a sprocket chain 236 which is led around a sprocket 237. The axis of the sprocket 237 is the pivot shaft 232. A second sprocket 238 is mounted upon the shaft 232 and carries a sprocket chain 239. This is led around a sprocket wheel 240 mounted upon the cam shaft 210. From an examination of this construction in Fig. 1 of the drawing, it will be seen that free vertical movement of the vacuum head 194 may take place without interrupting the driving action of the cam shaft 210 at any time.

Vacuum sealing operation

By reference to Figs. 13 to 17, inc., the sealing operation will be understood. It will be seen that mounted adjacent to the mouth of each of the mold elements 139 is a pair of folding fingers 140 and 141. These fingers normally extend vertically

and parallel to each other at opposite sides of the filled bag 23, which bag is in the position shown in Fig. 25 of the drawing. The folding fingers are mounted on pivots 142 and 143 and may swing downwardly from the dotted line position shown in Fig. 13 to the solid line position shown in that figure.

The swinging mechanism is shown in Figs. 9 and 10. It will be seen that the pivot shafts 142 and 143 carry gears 241 and 242. These gears are in mesh. The shaft 143 carries a trip lever 243 by which the gears are rotated to swing the folding fingers 140 and 141 downwardly. The trip lever is shown in Fig. 10, where it will be seen as having fingers 244 and 245. These fingers engage trip pins 246 and 247 which are mounted upon the reciprocating plate 276 and will act first to swing the lever and the set of folding fingers 140 and 141 into the position shown in Fig. 13 prior to a heat sealing operation, and to thereafter swing these fingers to the dotted line position shown in that figure as a set of molds 139 moves away from the sealing station.

The heat sealing in the present instance is performed by reciprocating heat and pressure applying members. Referring particularly to Figs. 13 and 14 of the drawings, it will be seen that mounted upon the vacuum head 194 is a series of cylinders 248 supported by bracket arms 248'. Mounted within each of these cylinders is a piston 249, which is moved downward by air pressure exerted through the air manifold 251 connected to the cylinder head 252. A cross-head 253 is carried by each of the pistons and has attached to it a pair of springs 254 which tend to draw the piston upwardly after the heat sealing operation. The piston carries a piston rod 255 which reciprocates with it and extends through an opening 256 in the vacuum head 194. The lower end of the piston rod 255 is fitted with a side arm 257 upon which is mounted an electric heating element 258. This is secured by a fastening member 259. The point of the heating element extends downwardly, and as shown in Fig. 13 has a slight blade-like protrusion 260 on it which comes into actual contact with the closed mouth of a container 23 during the sealing operation.

Drive mechanism

The machine is provided with a main drive shaft 261 (Fig. 3) which extends transversely of the frame structure and midway the length thereof. A drive pulley 262 is connected to one end of the shaft. Mounted upon the opposite end of the shaft and upon the opposite side of the frame structure is a worm gear 263 in mesh with a worm gear wheel 264. The worm gear wheel is carried upon the longitudinally extending shaft 128. This is mounted in a series of bearings 265 carried upon the frame plate 10.

Mounted upon the shaft 128 is a bevel gear 266 in mesh with a gear 267. The gear 267 is carried by a transverse shaft 268. This shaft at its outer end carries a sprocket 269 around which the sprocket chain 111 passes. The shaft 268 carries cam wheel 160 upon which the roller 159 of the cam lever 158 rests and by which it is moved. A cam 271 is also mounted on the shaft 268 and provides an operating surface for a roller 272 mounted on an arm 272' which swings on a horizontal pivot 273. The roller 272, as shown by dotted lines in Fig. 1, is mounted intermediate the ends of the arm 272', which arm is provided at its upper end with a pivot pin 274 connecting

with a pitman rod 275. The pitman rod 275 is connected at its forward end to a sliding block 276 which carries the trip pins 246 and 247 for the folding fingers. Thus, as the pitman rod reciprocates the fingers will move toward and away from their folding positions.

Mounted upon the frame is a transverse shaft 277 which provides support for cam levers 278. These levers are disposed at opposite sides of the main frame and extend substantially horizontally and each carries a cam roller 279 which rests upon a cam 280. The cams 280 are fixed upon the shaft 234. The free ends of the cam levers 278 are pivotally connected to connecting rods 281 which extend upwardly and connect to the vacuum head 194 at opposite ends thereof, so that as the levers 278 oscillate the vacuum head will raise and lower. Pitman rods 282 are connected to the levers 278 and are connected with the frame structure 167 of the bag spreading device and act to raise and lower this structure a relatively short distance with relation to the bag molds 139.

Mounted upon the shaft 234 is a disc 283 which carries a roller 284 for a Geneva motion. This roller engages radial slots 285 in an intermittent drive disc 286 carried upon the shaft 15, and upon which shaft the sprocket wheels 18 and 19 are mounted to receive the conveyor chains 20 and 21. This provides the intermittent drive for the conveyor chains and the other mechanism timed therewith. At the opposite end of the shaft 234 is a gear 287 which is in mesh with a pinion 288. This pinion is freely carried upon the intermediate shaft 277. A large gear 289 is also carried on the shaft 277 and is in mesh with a pinion 290 carried upon the main drive shaft 261. This train of gears transmits driving motion from the main drive shaft 261 to the cam shaft 234.

The main drive shaft 261 projects outwardly through the bed plate element 11 to receive the pulley 262. At a point intermediate the pulley 262 and the bed plate is a bevel gear 291 which is in mesh with a gear 292. The gear 292 is carried on a vertical shaft 293 mounted in a bearing 294. This bearing is secured to the side of the bed plate element 11. A bevel gear 295 is secured at the upper end of the shaft and is in mesh with a bevel gear 296. This gear is mounted upon a horizontal shaft 297 and is mounted in a bearing 298 carried on a bracket 299. The bracket overhangs the bearing 298 and is fitted with a pivot pin 300 which permits the shaft 297 to oscillate in a horizontal plane. At the opposite end of the shaft 297 from the gear 296 is a bearing 301. This slides in a horizontal slot in a bracket 302. At the free end of the oscillating shaft 297 is a gear 303. This gear is in mesh with a compound gear rack 304 carried on a plate 305. The plate 305 reciprocates vertically in ways 306. The marginal edges of the compound rack 304 are defined by parallel gear racks 307 and 308 connected at their opposite ends by semicircular gear racks 309 and 310. The rack plate 305 connects to a fitting 311 by a pin 312. It will be seen in Figs. 2 and 5 that the shaft 297 rotates continuously as driven by the main drive shaft 261, and that as the gear 303 continuously rotates in one direction its teeth will consecutively mesh with the rack teeth 307, 309, 308 and 310. The pivot pin 312 connects with the shaft 53 of the cross-head structure 48 carrying the bag forming members, as

shown in Fig. 6, and thus the plate 305 will be caused to reciprocate vertically.

Operation

In the operation of the present invention, power is delivered to the machine from a suitable power source through a driving belt to the pulley 216. This will constantly drive the main drive shaft 261, the longitudinal cam shaft 128, and the transversely extending cam shaft 268, as well as the intermittent driving shaft 234. The main drive shaft 261 imparts rotation to the intermittent driving shaft 234 through the train of gears 287, 288, 289 and 290. This will cause the disc 283 to rotate with its roller 284 and to consecutively engage the slots 285 in the intermittent driven disc 286, with the result that the shaft 15 will be intermittently driven. As shaft 15 is driven it will impart intermittent rotation to the sprockets 18 and 19 and will cause the sprocket chains 21 and 22 to be driven. As previously stated, these chains are led around sprockets 16 and 17 on sprocket shaft 14 at the opposite end of the frame of the machine. The sprocket chains carry the transversely extending mold units 138, each of which is fitted with a plurality of molds 139. The mold units with their molds are consecutively presented to the bag opening and forming station A, the filling station B, the spreading station C, and the vacuum sealing station D. During this operation the sprocket chain travels in the direction indicated by the arrow *a* in Fig. 1 of the drawing. The timing of the Geneva motion, which includes the roller 284 and the disc 286, causes the mold units to come to rest in vertical alignment and directly beneath the path of travel of the bag spreading and carrying members 49, as shown in Fig. 21 of the drawing. As has been previously stated, the bag spreaders 49 are carried upon a cross-head 48, shown in Fig. 6 of the drawing. This cross-head is slidably mounted upon parallel vertical standards 46 and 47 and is held in its uppermost position by chains 56 and 57, which are led around the sprocket wheels 58 and 59 upon the tension shaft 60. The cross-head is held in its uppermost position by the recoil action of the springs 65 and 66.

As the main cross-shaft 261 is driven the shaft 297 will be continuously driven through the train of gears shown particularly in Fig. 2 of the drawing, and which are interposed between the shaft 261 and the shaft 297. In Fig. 2 of the drawing the shaft 297 and its driven gear 303 is continuously rotated and produces alternate reciprocation of the rack plate 305, which will draw the spreading unit cross-head 48 downwardly from the position shown in Figs. 1, 6 and 21 to the position shown in Fig. 22. While the spreading unit cross-head 48 is in its uppermost position the cam 106, as shown in Figs. 1 and 21, will be rotated so that the springs 105 retract the arm 97 and draw the vacuum suction cups 102, holding side 24 of the foremost package blank 23 to receive the spreading unit 49. However, as the shaft 108 of the cam 106 is driven through the chain 111 from the cross shaft 268, the arms 97 will be swung in the direction of the arrow *b* in Figs. 1 and 21 to bring the suction cups 102 into physical engagement with the face of the portion 24 of the package blank 23. As this takes place, suction will be exerted upon the outer leaf or fold of the blank so that the outer fold will be drawn outwardly, as shown in Fig. 29 of the drawing, and the inner

fold 25 will hang along its upper edge in the rear of the retaining lip 116. While the bag blank is in this position the members 118 will tend to keep the mouth of the packages 23 open so that the spreading units 49 may move downwardly and enter the mouths of the set of bags which have been drawn from the bins of the magazine 27 and will pull the bags loose from the forward lip 116 and carry the bags downwardly into the mold units 138 and into the molds 139.

As previously stated, the spreading units 49 are formed with a plurality of walls articulately connected, as shown in Fig. 27 of the drawing. As these units move downwardly the bags will move between the guide and forming plates 130 so that the sides 81 and 82 will be forced inwardly and the sides 79 and 80 will be forced outwardly to give the proper rectangular cross-sectional shape to the bag. As the bag continues to move downwardly, as shown in Fig. 6 of the drawing, it will pass between the pressing rollers 133, which yieldably bear against the opposite edge walls and forcibly fold the seams 132 against the side of the wall, as shown in Fig. 24 of the drawing. As the forming units 49 continue to move downwardly the bottom walls will be moved upwardly to a position of alignment so that the forming units will be expanded and the bag will be expanded and formed, as indicated in Fig. 24 of the drawing. As the drive mechanism associated with shaft 297 continues to function, the bag forming units will be retracted and collapsed and the cross-head will move to its uppermost position, due to the driving action of the plate 305 and the recoil action of the springs 65. The cycle of operation of the bag opening and positioning means will thus be completed.

When the package has been formed and placed in the mold 139 in the shape shown in Fig. 24 of the drawing, it will stand with the open mouth in the position shown by dotted lines in Fig. 13. In this condition the set of unfilled containers are moved from the station A to the station B as the conveyor chains 20 and 21 are driven intermittently. At station B the spouts 147 will be in alignment with the mouth of the containers 23 as shown in Figs. 1, 2, 18 and 19. When in this position the lever 151 will be oscillated so that it will swing in the direction of the arrow c, as shown in Fig. 2, and will move the spouts 147 downwardly. The lever 151 is operated through a connecting rod 155 which is secured to the lever end 156 and is operated by the cam 160 carried on the shaft 268. As the cam operates the spout will be lowered into the mouth of the bag 23 and material will fill into the bag. It has been found that in order to firmly pack the bag the lower end of each spout is made with the projecting portions 161 and 162 and the cutaway sides, thus allowing uniform distribution of the material as it flows from the end of the spout and into the bag.

After a set of bags 23 has been filled at the filling station B the intermittent conveyor drive will carry the filled bags to the spreading station C. At the spreading station C the row of molds 139 will be disposed beneath the structure shown in Figs. 7 and 8. While in this position the spreading bars 168 and 169 will move from their retracted positions, as shown in Fig. 7, to their extended positions as shown in Fig. 8. This is accomplished due to the fact that each of the bars is fitted with a gear rack in mesh with gear pinions 173 and 175, which pinions in turn mesh

with the transverse rack bar 177. The rack bar 177 moves horizontally as actuated by the swinging movement of the lever 180 to which the free end of the rack bar is connected. The lever 180 is mounted upon the shaft 181 and is operated by the cam 186 carried upon the longitudinally extending drive shaft 128, and which cam swings the lever 184. When the spreading bars 168 and 169 are moved to the position shown in Fig. 8 of the drawing the ends of the bars, indicated in detail in Fig. 11, will swing outwardly, as shown in Fig. 30, so that the mouth of the container will be spread and substantially creased to facilitate in the final folding and sealing operation. A reverse swinging action of the lever 180 will then move the spreading bars 168 and 169 to their retracted positions, after which the next movement of the conveyor chains will position the mold unit beneath the vacuum head 194. When the trough-like portion of the mold unit 138 is in alignment with the vacuum head the vacuum head is lowered into position by action of levers 278 which are operated by the cam 280 over which the cam roller 279 rides. As the vacuum head 194 is lowered into position it will make a tight seal with the mold unit 138 so that suction can be applied. Prior to this action, however, the bell crank formed by lever arms 244 and 245 engaged a pin 246 so that the gears 241 and 242 would be rotated and the folding blades 140 and 141 would be folded down to the position shown in Fig. 15 of the drawing. This will temporarily hold the folded end of the bag so that the abutting faces of the portions 24 and 25 will be held against each other and folded over directly above the material with which the bag 23 is filled. In this condition the cam shaft 110 rotates to operate the cams thereon and to cause the valve 202 to open for a predetermined period as a low negative pressure is exerted upon the packages in the molds to evacuate the air from the packages and from around the material therein without disturbing the material so that it would be drawn between the opposed faces forming the seal. As the cam shaft continues to rotate the valve 202 will close and the valve 214 will open. This valve establishes connection with suction means, whereby a high suction pressure is exerted to complete the vacuum action and to render the package under a high partial vacuum. A control valve 313 is then actuated to admit air and to force the heating element 259 downwardly from within the vacuum head 194 to contact the overlapping mouth of the bag and to forcibly press the edge 260 of the heating element against the overlapping portion of the bag, so that it will be held firmly against the member 144 of the folding blade 141. This will cause the inner surfaces of the walls of the bag 23 to be heat sealed under a condition of high partial vacuum. When the valve 313 is next manipulated the heating element will be retracted from the position shown in Fig. 14 to the position shown in Fig. 13. The operation of the cam shaft 210 will close the valve 214 after the sealing operation has been completed, and then the valve 222 will open to permit atmosphere to enter the vacuum head 194 and pass around the packages 23 in the molds 139. When this takes place the packages will be shaped to agree in configuration with that of the molds 139 in the manner set forth and claimed in my Patent No. 2,241,943 issued May 13, 1941. As the operating cam 280 moves, the vacuum sealing head 194 will

be lifted so that the set of molds 139 may be advanced to a discharge point of the machine, such for example as at X in Fig. 1 of the drawing.

It may be found necessary in connection with certain types of food products to subject the filled package to a prolonged vacuumizing period under either low suction or high suction action, in which event it will be possible to subject a plurality of molds to low suction action at one station and a plurality of molds to high suction action at the final seaming station. Thus, the final seaming operation may be taking place while the initial suction action is being applied to the unsealed packages.

It will thus be seen from the foregoing disclosure that means are provided whereby collapsed paper bags with non-reentrant folds may be maintained in hoppers and fed to the machine, where they are opened, shaped, filled and heat sealed by a simple continuous and automatic operation.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art, without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A machine for forming and sealing a package formed from a flat sheet of material having a continuous fluid-tight and fusible inner envelope, the walls of which envelope at the top are free from seams and folds between the ends thereof; which comprises a member formed with a cavity of the shape to be assumed by the final package and within which said envelope is placed, means inserted into said envelope to spread the envelope to conform to the cavity and to permit the bag to be filled when said forming means is removed, means moving into the open mouth of the envelope to engage the end walls of the envelope at the top and intermediate the width thereof to separate the end walls until the opposite perimeter lengths of said walls are drawn

substantially together, and a set crease is made in the opposite end walls at the points of engagement therewith, means for applying suction to said package to withdraw the atmosphere therefrom, and means to engage the opposite perimeter lengths of said walls at the mouth thereof and to apply heat and pressure while sealing the package.

2. A machine for forming and sealing a package formed from a flat sheet of material having a continuous fluid-tight and fusible inner envelope, the walls of which envelope at the top are free from seams and folds between the ends thereof; which comprises a member formed with a cavity of the shape to be assumed by the final package and within which said envelope is placed, means inserted into said envelope to spread the envelope to conform to the cavity and to permit the bag to be filled when said forming means is removed, means moving into the open mouth of the envelope to engage the end walls of the envelope at the top and intermediate the width thereof to separate the end walls until the opposite perimeter lengths of said walls are drawn substantially together and a set crease is made in the opposite end walls at the points of engagement therewith, and means to engage the opposite perimeter lengths of said walls at the mouth thereof and to apply heat and pressure while sealing the package.

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